

Application No. 09/892,161
Amendment "C" and Response dated October 31, 2005
Amendment and Response to Office Action mailed 09/20/2005

AMENDMENTS TO THE CLAIMS

Please amend the claims as reflected in the following claim listing. *This listing of claims will replace all prior versions of listing of claims in the application:*

1. **(Currently Amended)** A method of mirroring data stored on a first server having a first mass storage device to a second server having a second mass storage device to establish a virtual storage area network that includes the first and second mass storage devices, the method comprising:

receiving a write request at the a first server from a network device, the first server having a first mass storage device;

issuing a write operation request to a second server, the second server having a second mass storage device;

determining that the first server has write access to both the first mass storage device and to the second mass storage device by performing a policing protocol in response to the write operation request;

using an I/O driver of the first server, executing the write request at the first server to write data to the first mass storage device;

using a mirror engine of the first server, transmitting a copy of the write request to the second server; and

executing the copy of the write request at the second server using a mirror engine of the second server to write the data to the second mass storage device without processing the write request using an I/O driver of the second server, thereby mirroring the data at the second mass storage device, wherein the data is stored in a virtual shared storage node associated with the first server and the second server.

2. **(Previously Presented)** A method of mirroring data as recited in claim 1, wherein transmitting a copy of the write request comprises transmitting the copy of the write request using a dedicated link between the first server and the second server.

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3. **(Previously Presented)** A method of mirroring data as recited in claim 1, wherein transmitting a copy of the write request comprises transmitting the copy of the write request using infrastructure of the network, wherein the infrastructure is used by the network to transmit data between workstations and servers.

4. **(Previously Presented)** A method of mirroring data as recited in claim 1, further comprising:

experiencing a failure such that the data is not accessible from the first mass storage device; and

executing a read request for data that has been written to the first mass storage device by accessing the data that has been mirrored at the second mass storage device.

5. **(Original)** A method of mirroring data as recited in claim 4, wherein the failure comprises the first server going offline.

6. **(Original)** A method of mirroring data as recited in claim 4, wherein the failure comprises a failure of the first mass storage device.

7. **(Previously Presented)** A method of mirroring data as recited in claim 1, further comprising using a policing protocol, prior to executing the write request at the first server, to determine whether the first server has write access.

8. **(Cancelled)**

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9. (Currently Amended) A method of mirroring data stored on a first server having a first mass storage device to a second mass storage device of a second server so that the data is accessible to the first server and the second server through a virtual storage area network, the method comprising:

establishing a virtual storage area network between the first server and the second server that includes a virtual shared storage node, wherein the virtual shared storage node physically includes:

the a first mass storage device connected with the first server;

the a second mass storage device connected with the second server;

means for mirroring data between the first mass storage device and the second mass storage device; and

means for communicating between the first server and the second server; receiving a write request that specifies that data is to be written to the virtual shared storage node;

issuing a write operation request to the second server;

determining that the first server has write access to the virtual shared storage node by performing a policing protocol in response to the write operation request, including write access to the first mass storage device and write access to the second mass storage device;

writing the data to the first mass storage device, the data at the first mass storage device being accessible by the first server; and

transmitting a copy of the write request to the second server so that the data can be mirrored to the second mass storage device by a mirror engine of the second server, the data at the second mass storage device being accessible by the second server.

10. (Original) A method of mirroring data as recited in claim 9, wherein said means for mirroring data comprises a first mirror engine associated with the first server and a second mirror engine associated with the second server.

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11. **(Previously Presented)** A method of mirroring data as recited in claim 9, wherein transmitting a copy of the write request comprises using the first mirror engine to initiate transmission of the copy of the write request to the second mirror engine.

12. **(Original)** A method of mirroring data as recited in claim 9, wherein the means for communicating comprises a dedicated link for transmitting data between the first server and the second server.

13. **(Original)** A method of mirroring data as recited in claim 9, wherein the means for communicating comprises infrastructure of the network, wherein the infrastructure is also used by the network to transmit data between workstations and servers.

14. **(Previously Presented)** A method of mirroring data as recited in claim 9, further comprising:

experiencing a failure such that data is not accessible from the second mass storage device;

executing a read request for other data, wherein the other data has been stored in the virtual shared storage node in response to the second server having received a write request specifying that said other data is to be written to the virtual shared storage node, the read request being executed by accessing the data from the virtual shared storage node.

15. **(Previously Presented)** A method of mirroring data as recited in claim 14, wherein executing the read request by accessing the data from the virtual shared storage node comprises accessing the data from the first mass storage device.

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16. **(Currently Amended)** A method of mirroring data stored on a first mass storage device of a first server to a second mass storage device of a second server to establish a virtual storage area network that includes the first mass storage device and the second mass storage device, the method comprising:

receiving a write request at the a first server, the first server connected with a first mass storage device;

issuing a write operation request to the second server in response to the write request;

using a policing protocol module associated with the first server, determining that the a second server does not currently have write access priority to a portion of the first mass storage device or a portion of the a second mass storage device, the second mass storage device connected to the second server;

providing the first server with write access priority to the portion of the first mass storage device and to the portion of the second mass storage device; and

while the first server has write access priority to the portion of the first mass storage device and to the portion of the second mass storage device:

executing the write request at the first server to write data to said portion of the first mass storage device; and

using a mirror engine of the first server, transmitting a copy of the write request to the second server so that the data can be written to the second mass storage device while the first server has write access priority, thereby enabling both the first server and the second server to access the data.

17. **(Previously Presented)** A method of mirroring data as recited in claim 16, wherin using the policing protocol module comprises the first server communicating to the second server to determine that the second server does not currently have write access priority.

18. **(Previously Presented)** A method of mirroring data as recited in claim 17, wherein communicating is performed by communicating over infrastructure of the network, wherein the infrastructure is also used by the network to transmit data between workstations and servers.

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19. **(Previously Presented)** A method of mirroring data as recited in claim 16, further comprising:

experiencing a failure such that data is not accessible from the second mass storage device;

executing a read request for other data, wherein the other data has been mirrored to the first mass storage device in response to the second server having received another write request specifying that said other data is to be stored, the read request being executed by accessing the data from the first mass storage device.

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20. (Currently Amended) A virtual storage area network that enables a first server and a second server to access the same data from physically different mass storage devices, the virtual shared access network comprising:

a first server that is capable of receiving write requests and read requests from network clients, the first server having:

a first mass storage device; and

a first mirror engine;

a second server that is capable of receiving write requests and read requests from network clients, the second server having:

a second mass storage device; and

a second mirror engine; and

a means for communicating between the first mirror engine and the second mirror engine that performs at least the following functions:

issuing a write operation request in response to a write request received from a particular network client at one of the first server and the second server;

determining when the first server or the second server has write access to both the first mass storage device and the second mass storage device by performing a policing protocol in response to the write operation request;

enabling the first mirror engine to mirror to the second mass storage device first data using the second mirror engine of the second server, wherein the first data that is also to be written to the first mass storage device; and

enabling the second mirror engine to mirror to the first mass storage device second data using the first mirror engine of the first server, wherein the second data that is also to be written to the second mass storage device;

thereby enabling the first server and the second server to access the same data from physically different mass storage devices.

21. (Original) A virtual storage area network as recited in claim 20, wherein the means for communicating comprises a dedicated link between the first mirror engine and the second mirror engine.

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22. **(Original)** A virtual storage area network as recited in claim 20, wherein the means for communicating is included in infrastructure of the network, wherein the infrastructure is also used by the network to transmit data between workstations and servers.

23. **(Original)** A virtual storage area network as recited in claim 20, further comprising a third server that is capable of receiving write requests and read requests from network clients, the third server having:

a third mass storage device; and

a third mirror engine, wherein the third mirror engine is capable of mirroring, to the first mass storage device and the second mass storage device, data that is to be written to the third mass storage device.

24. **(Original)** A virtual storage area network as recited in claim 23, further comprising means for communicating between the third server and the first server and also between the third server and the second server.

25. **(Original)** A virtual storage area network as recited in claim 20, wherein the first server and the second server execute a policing protocol to determine whether a server, upon receiving a write request, has write access priority for writing data to the first mass storage device and the second mass storage device.

26. **(Previously Presented)** A virtual storage area network as recited in claim 25, wherein the policing protocol enables the first server and the second server to write data to a particular portion of the first mass storage device and the second mass storage device in response to a write request when the policing protocol determines if the write request has priority over any other write request that might be pending for the particular portion of the first mass storage device and the second mass storage device, wherein the write request is queued until the write request is granted to the first server and the second server if the policing protocol determines that the write request does not have priority.

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27. **(Original)** A virtual storage area network as recited in claim 25, wherein:
the first server further has a first policing protocol module; and
the second server further has a second policing protocol module, wherein the first
policing protocol module and the second policing protocol module are used together to
execute the policing protocol.

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28. **(Currently Amended)** A method of mirroring data stored on a first mass storage device of a first server to a second mass storage device of a second server to establish a virtual storage area network that includes the first mass storage device and the second mass storage device, the method comprising:

receiving a write request at the first server, the first server connected with a first mass storage device;

issuing a write operation request to a second server, the second server connected with a second mass storage device;

performing a policing protocol in response to the write operation request to ensure that the first server has write access to at least a portion of the first mass storage device and at least a portion of the second mass storage device;

using an I/O driver of the first server, executing the write request at the first server to write data to the first mass storage device;

transmitting the write request to a mirror engine of the second server; and

without processing the write request using an I/O driver of the second server, executing the write request at the second server to write the data to the second mass storage device, thereby mirroring the data at the second mass storage device.

29. **(Original)** A method of mirroring data as recited in claim 28, wherein the data, from the standpoint of the first server and the second server, virtually appears to have been stored in a shared storage node of a storage area network.

30. **(Previously Presented)** A method of mirroring data as recited in claim 28, wherein transmitting the write request to the second server is performed by transmitting a copy of the write request that was executed at the first server.

31. **(Previously Presented)** A method of mirroring data as recited in claim 28, wherein transmitting the write request to the second server is performed by a mirroring engine.

32. **(Original)** A method of mirroring data as recited in claim 31, wherein the mirroring engine is associated with the first server.

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33. **(Previously Presented)** A method of mirroring data as recited in claim 28, further comprising:

experiencing a failure such that the data is not accessible from the first mass storage device; and

executing a read request for data that has been written to the first mass storage device by accessing the data that has been mirrored at the second mass storage device.

34. **(Original)** A method of mirroring data as recited in claim 33, wherein the failure comprises the first server going offline.

35. **(Original)** A method of mirroring data as recited in claim 33, wherein the failure comprises a failure of the first mass storage device.

36. **(Previously Presented)** A method of mirroring data as recited in claim 28, wherein transmitting the write request comprises transmitting the write request using a dedicated link between the first server and the second server.

37. **(Previously Presented)** A method of mirroring data as recited in claim 28, wherein transmitting the write request comprises transmitting the write request using infrastructure of the network, wherein the infrastructure is also used by the network to transmit data between workstations and servers.

38. **(Previously Presented)** A method of mirroring data as recited in claim 37, wherein executing the write request at the first server comprises using an I/O driver at the first server to initiate execution of the write request, wherein, from the standpoint of the I/O driver, the write request virtually appears to have been stored in a shared storage node of a storage area network.

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39. (Previously Presented) A method of mirroring data as recited in claim 28, further comprising using a policing protocol, prior to executing the write request at the first server, to determine whether the first server has write access.